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CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 14 November 2003 with an application for Letters Patent number 529554 made by Peter Dudley Elston; Robbie John Buwalda; Daniel Smith; Graham Peter Davey; Warren John Fitzimons.

Dated 13 December 2004.

Neville Harris
Commissioner of Patents, Trade Marks and Designs

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PROVISIONAL SPECIFICATION

DAIRY PRODUCT AND PROCESS

We, Peter Dudley Elston, Robbie John Buwalda, Daniel Smith, Graham Peter Davey and Warren John Fitzimons, all of Fonterra Research Centre, Private Bag 11029, Dairy Farm Road, Palmerston North, New Zealand do hereby declare this invention to be described in the following statement:

DAIRY PRODUCT AND PROCESS

FIELD OF THE INVENTION

The present invention relates to a novel process of making mould-ripened cheese and to cheese products made by said process.

BACKGROUND OF THE INVENTION

Mould ripened cheese has been prepared widely across Europe for many centuries using often labour intensive methods. This generic class of cheese includes some well-known varieties such as Roquefort, Stilton, Gorgonzola, Blue (Bleu, Danablu), Camembert, and Brie.

The characteristics of mould ripened cheeses depend greatly on the ripening process during which the selected strains of mould mycelia infiltrate the cheese causing extensive development of flavour and the characteristic texture of the product.

In traditional mould ripened cheese a range of organisms are utilised. These include, but are not limited to, fungi from the families of *Penicillium*, *Mucor*, *Cladosporium*, *Geotrichum*, *Epicoccum*, and *Sporotrichum*. Selected strains of the *Penicillum* family are the most widely utilised commercially.

Consumer tastes for mould-ripened cheeses vary considerably; some preferring strong flavours, others more bland. This presents manufacturers with the problem of identifying the best time to place quantities of product on the market for sale – too soon means that there is little ripening, slight flavour development and appeal to only a limited segment of the market; too much ripening and the flavour becomes too intense for broad market appeal. This problem also affects the consumer who is faced with a risky purchase as a result.

Some cheese manufacturers have developed various methods in an attempt to overcome these problems. One known method used to achieve greater control of the flavour development of mould ripened cheese is the careful selection of the varieties of mould. However this makes the control of

the microbiological state of the product and potential contamination during the process more critical.

Another method is to market separate products from different maturation periods (such as 21, 27 and 35 day old Camembert).

A further known method is to standardise the flavour of such cheese by ripening the cheese to the optimal extent and then heat-treating the cheese to arrest all microbiological processes. However, this process can cause undesirable flavour and unusual textural changes in the cheese. As a result, heat treated cheeses are often marked down in price.

Some manufacturers try to avoid this problem by making comparatively small batches on a regular basis throughout the year. The consumer can then buy regularly a relatively immature product, which can be stored by the consumer until the preferred state of ripening is reached. This is not ideal for the manufacturer as they have a product that cannot be shipped any great distance. Furthermore the consumer may not have ideal conditions for holding the cheese for further ripening, for example the refrigerator, which is often the most convenient domestic cheese ripening environment, risks contamination of the cheese by taints from other foods present.

It is also known that most cheese produced by conventional means cannot, in general, be stored frozen without major disruption to the texture of the curd mass. Camembert is an exception in that it can be frozen to arrest biochemical activity and successfully thawed.

A further problem in the conventional manufacture of mould-ripened cheese is that the traditional flavour and texture develops over a period that takes one or more months. This incurs costs both in holding of the stock in the maturation stage as well as the uncertainty of quality until the finished product has attained the target level of maturation. Quality defects that take months to become evident represent expensive failures that the consumer ultimately carries.

Traditional Camembert and Brie cheese varieties ripen progressively from the surface towards the core. The ripened zone typically attains a soft spreadable consistency. This material is too soft to shred satisfactorily.

Gamelost, a semi-hard cheese from Norway, is made by first precipitating casein from skim milk by the addition of acid and cooking at about 65°C. The casein is separated off from the whey, collected and formed into a mass and moulded by heating for about 2 hours in boiling whey. After cooling (the following day) the surface of the cheese is sprayed with a suspension of Mucor mould and then placed in storage to ripen (Fox P.F. (editor), Cheese: chemistry, physics and microbiology. Vol 2 Major cheese groups. 2nd edn. Chapman & Hall, London). This traditional cheese adopts a direct acid addition method to produce curd and then uses heat to form a coagulated cheese mass. The mould is then applied to the surface of the cheese mass. Little fat can be incorporated efficiently into the curd using this technique because of losses into the whey bath. Ripening will be slow depending on the size of the cheese mass because the mould will have difficulty penetrating towards the core of the mass.

A process that speeds up the production of mould ripened cheese is known in the art. Kosikowski & Mistry – Cheese and Fermented Milk Foods Vol. 1. 3rd edn., 1997, teaches a recombining process to prepare blue cheese that is ready for immediate consumption following packaging. Skim milk is concentrated using ultrafiltration. Concomitantly, a cream or fat-rich flavour concentrate is prepared using predominately cream, spores of *P. roqueforti*, microbial lipase and optionally starter bacteria or whey. The mixture is fermented to produce the required flavour stock. The flavour stock is blended with the ultrafiltered retentate and heated to about 77°C for about 3 minutes. The cream cheese-like mass is packaged and chilled and is ready for consumption. This process has many attractive features. However, it does not suggest the means to control the calcium content of the retentate and thereby manipulate the texture of the product in the subtle ways that is expected by the consumer of traditionally matured mould-ripened cheeses. There is no suggestion in the art that a mould flavoured cheese prepared by a recombining process is freeze-thaw stable. No process for the preparation of mould flavoured cheese has revealed a means to shred the cheese.

Any process for making cheese or a cheese precursor that provides reliable control of the desired flavour and texture of mould-ripened cheese and allows rapid production.

It is an object of the present invention to provide such a process and/or at least to provide the public with a useful choice.

DISCLOSURE OF THE INVENTION

In one aspect the present invention provides a process for preparing cheese comprising:

(a) providing a protein concentrate,

(b) providing a flavour concentrate using at least one strain of organism,

(c) mixing the protein concentrate and flavour concentrate with a source of fat and/or liquid if required and heating to form a coagulated cheese mass and if required inactivating the flavour producing organisms,

(d) cooling the resulting coagulated cheese mass to form a cheese precursor with an exposed surface,

(e) applying viable organisms to the exposed surface,

(f) allowing the cheese to ripen.

Optionally, the cheese obtained can be divided into portions. Optionally this ripened cheese can be frozen.

Other ingredients may conveniently be added at step (c).

In another aspect, the present invention provides a process for preparing a cheese comprising:

(a) providing a protein concentrate,

(b) optionally providing a flavour concentrate using at least one strain of organism,

(c) mixing the protein concentrate with a source of fat and/or liquid if required and heating to form a coagulated cheese mass,

(d) cooling the coagulated cheese mass and mixing in a flavour concentrate containing viable organisms to form a cheese precursor,

(e) optionally dividing the cheese precursor into consumer portions,

(f) allowing the cheese precursor or the portions to ripen,

(g) optionally freezing the ripened cheese.

Where there is one or more additions of flavour concentrate, the concentrate may be the same or different.

Other ingredients may conveniently be added at one of steps (c) and/or (d).

In one embodiment, the steps include applying viable organisms to the exposed surface, and allowing the cheese to ripen.

In another aspect, the present invention provides a process for preparing a cheese comprising:

(a) providing a protein concentrate,

(b) providing a flavour concentrate using at least one strain of organism,

(c) mixing the protein concentrate and flavour concentrate with a source of fat and/or liquid if required and heating to form a coagulated cheese mass and if required inactivating the flavour producing organisms,

(d) dividing the cheese mass into portions,

(e) optionally freezing the cheese portions.

Preferably the precursor cheese or the ripened cheese may be shredded or particulated.

Other ingredients may conveniently be added at step (c).

Freshly prepared flavour concentrate may be used. Alternatively, the flavour concentrate may be preserved before its incorporation into the curd mass. A preferred method of preservation of the flavour concentrate is drying and a particularly preferred method is freeze-drying. Optionally, the preserved flavour concentrate may be stored and/or shipped prior to its incorporation into the curd mass.

Protein concentrate as used herein means any solution, slurry, suspension or paste of protein capable of forming a homogenous mass upon heating and subsequent cooling to room temperature. It also includes solids (for example a powder) which when mixed with liquid have the same capability. Preferably the protein concentrate is formed from rennetted milk where the calcium concentration is controlled by manipulation of the pH at which the curd is cooked or by using acidified wash water to wash the cooked curd or both. In other preferred options, the calcium concentration in the protein concentrate is controlled using ion exchange and optional ultrafiltration as published in PCT published application WO 02/082917 or by the method described in published PCT application WO 03/069982.

Flavour concentrate as used herein means a flavourful solution, slurry, suspension, paste or powder prepared using edible fungus and/or yeast. Preferably the flavour concentrate is prepared as a result of a fermentation procedure involving the growth of at least one selected strain of edible fungus or

yeast or alternatively the flavour concentrate is prepared using non-viable edible fungus and/or yeast.

Preferably the viable organisms used in the process of the present invention contain selected species of mould with optional bacterial cultures. Preferred cultures are selected commercial strains of lactic, propionic or butyric acid producing bacteria.

In preferred embodiments, the precursor cheese or cheese product may be frozen for storage or transport purposes.

Preferably, the mould organisms used are selected from the family of fungi. More preferably the fungi are from the families of *Penicillium*, *Mucor*, *Cladosporium*, *Geotrichum*, *Epicoccum*, and *Sporotrichum*. The *Penicillum* family is the most preferred organism; strains of *P. candidium* and *P. roqueforti* are particularly preferred. More than one organism may be used.

Preferably, the percentage of flavour concentrate relative to the total coagulated cheese mass is in the range 0.1% to 20%, preferably 0.5% to 10%, most preferably 1% to 5%.

Preferably the protein concentrate, a fat source, and the flavour concentrate are mixed using a mixing-heating device (blender/cooker). The heat used in the cooking stage may be applied directly, indirectly or in combination. A preferred direct form of heat is culinary steam. The blender/cooker may be operated either batch-wise or continuously.

By varying the ratio of the protein concentrate, fat and flavour concentrate in the coagulated cheese mass or cheese precursor the flavour and texture in the final product can be controlled.

The fat source is preferably cream, butter, or oil. If cream is used, it may be homogenised prior to mixing with the protein concentrate and optional ingredients. Oil or fat may be mixed with a quantity of skim milk and preferably homogenised prior to adding to the recovered curd.

The heating step is preferably carried out by heating to at least 60°C for between 1 second and 120 minutes, preferably 10 seconds and 30 minutes, most preferably 20 seconds and 15 minutes. More preferably, the mixture is heated to between 70°C and 90°C, most preferably, heated to between 75°C and 85°C.

Preferably ripening is conducted at temperatures between 5°C and 35°C, more preferably between 10°C and 20°C and a relative humidity greater than 80%, preferably greater than 90%. The ripening period may between 1 day and 30 days, and preferably between 5 days and 20 days.

In a further aspect the present invention provides a cheese precursor or cheese produced by a process according to the present invention. Preferred cheeses produced using the process of the invention are Camembert and blue cheese, mushroom flavoured style cheese and blue flavoured style cheese.

Fat in dry matter in the cheese product is preferably between 10% and 80%, more preferably 20% and 60%. The protein/water ratio in the cheese product is preferably between 0.1 and 1.2 and more preferably between 0.25 and 0.8.

It will be recognised by those skilled in the art that analogues of dairy products described herein can be made according to the invention using non-milk protein sources.

Preferred embodiment – Preparation of protein concentrate

In a preferred embodiment for preparing the protein concentrate, pasteurised milk, or more preferably pasteurised skim milk (non-fat milk) from any suitable mammal is treated with an enzyme capable of converting kappa casein to para-kappa casein. The enzyme may be of animal, vegetable or microbiological origin. A preferred enzyme is rennet. The enzyme reaction is conducted at a temperature below 15°C and more preferably below 10°C, for a period preferably greater than 1 hour and preferably less than 24 hours.

Alternatively, the milk to be pasteurised may be non-fat or low fat milk may be obtained by reconstituting milk powders with a potable solvent. Suitable solvents include water or skim milk. Blends of fresh milk and reconstituted milk may also be used.

After the enzyme reaction is completed, the treated milk is acidified to a pH of about 5.4. Food approved acids can be used, such as dilute sulphuric acid. Optionally, a portion of the pasteurised skim milk may be fermented with the addition of a food approved starter culture (such as a lactic culture) to produce the required acidity.

The acidified mixture may be cooked by the application of heat to a temperature of between 30°C and 50°C and preferably between 40°C and 48°C and most preferably between 44°C and 46°C. One method of heating that can be used is by the direct addition of culinary steam. Once at the desired cooking temperature, the mixture is held for about 50 seconds before the curds and whey are separated. Preferred holding times are between 1 second and 300 seconds. Any method may be used to separate the curds and whey but a combination of screens and decanters is one method.

The dewheyed curd is then washed using water at a temperature of between 20 and 50°C, more preferably 30°C to 45°C and most preferably 35°C to 40°C for a period of a few minutes. Optionally the wash water may be acidified with a food-approved acid (such as sulphuric acid) to a pH of about 2.6. A ratio of wash-water to curd of at least 0.25:1.0 (water to starting skim milk equivalent) may be used, but a ratio of between 0.5:1.0 and 1.0:1.0 is preferred.

After washing, the curd is recovered from the wash-water using similar methods as used for curd serum separation. After dewatering, the protein concentrate has a preferred moisture content of greater than 30% w/w. More preferably the washed and dewatered protein concentrate has a moisture content between 40% and 55% w/w (wet basis).

By manipulation of the pH of the treated milk, the coagulum cooking temperature and the pH of the wash water, the divalent cation concentration in the protein concentrate may be varied at will in the range 100 mM/kg protein to 700 mM/kg protein. More preferably, the calcium content of the protein concentrate is between 150 mM Ca/kg protein and 500 mM Ca/kg protein.

Optionally at this stage, the protein concentrate may be packed and placed into storage for shipping and/or subsequent use. Optionally the protein concentrate is salted with 1% to 2% common salt, preferably 1.5-1.7% salt before being packed. Storage may be achieved by freezing the recovered curd and storing at a temperature below -10°C, more preferably below -18°C. Alternatively the protein concentrate is used directly for conversation into the final cheese product.

In an alternative embodiment, a protein concentrate may be prepared by the hydration of milk concentrate powder (MPC). Water is a preferred hydrating agent. Preferred MPC powders are divalent depleted MPCs prepared according to techniques disclosed in NZ 511095. The hydrated MPC may contain between 20% and 85% solids, more preferably between 40% and 70% solids. Alternatively a divalent depleted retentate may be used; prepared according to techniques disclosed in NZ 511095. Preferably the divalent depleted retentate contains greater than 40% solids.

Preferred embodiment – Preparation of flavour concentrate

A flavour concentrate may be prepared using at least one strain of mould by a variety of methods. One method of preparing a flavour concentrate has been disclosed by Kosikowski & Mistry.

A preferred method of preparing a flavour concentrate is to form a layer of cheese curd on a surface, preferably a tray. Cheese curd prepared by any convenient method is suitable as long as the water activity is greater than 80% and preferably greater than 90% and the salt concentration is less than 2% and preferably between 1% and 1.5%. The layer may be a continuous film of curd or may be particulate. Preferably the layer is less than 20 mm thick and more preferably 5mm to 10 mm thick. The curd layer is inoculated with a selected strain of viable mould spores. Preferably, the mould spores used are selected from the family of fungi. More preferably the fungi are from the families of *Penicillium*, *Mucor*, *Cladosporium*, *Geotrichum*, *Epicoccum*, and *Sporotrichum*. The *Penicillum* family is the most preferred organism; commercial strains of *P. candidium* and *P. roqueforti* are particularly preferred. Any convenient method of applying the spores may be used but spraying a mixture of spores dispersed in a sterile medium is preferred. Optionally, selected strains of bacteria and yeasts along with any nutrients may also be applied along with the spores in the medium. Preferred nutrients are fats, proteins, vitamins, enzymes and mineral salts. Preferred strains of bacteria are selected commercial cultures of lactic, propionic or butyric acid producing bacteria. The treated curd is held in an environment that facilitates rapid growth of the mould spores on the cheese substrate. Preferred conditions are temperatures between 10°C and 40°C, more preferably between 20°C and 30°C and a relative humidity of greater than 90% and preferably at least 95%. Mould growth may be continued until a highly flavoured concentrate is formed. Preferably a growing period of between 5 and 10 days is applied. Optionally, during the growing period the treated curd may be manipulated to expose untreated curd surface and further applications of spores applied.

Optionally, the flavour concentrate may be preserved for further use or shipment. Preferably the flavour concentrate may be dried, and more preferably freeze dried.

Preferred embodiment - Preparation of cheese

The protein concentrate along with other ingredients are mixed and heated to form a coagulated cheese mass.

The protein concentrate is placed in a mixer-cooker together with cream (or butter, or a source of fat or oil), and optional ingredients. The mixer-cooker may be operated either batch-wise or continuously.

If cream is used, it may be homogenised prior to mixing with the protein concentrate and optional ingredients. Oil or fat may be mixed with a quantity of skim milk and preferably homogenised prior to adding to the recovered curd.

Said optional ingredients may include the flavour concentrate prepared above, emulsifying salts, common salt, food approved acid or alkali, whey protein retentate, whey protein concentrate (or isolate) (WPC, or WPI), flavours and colour and any other ingredients permitted by CODEX Standard 221-2001, *Codex standard for unripened cheese including fresh cheese*, which is incorporated by reference. The pH range of the mixture may be between 4.5 and 7.5, preferably between 5.0 and 7.0.

The mixture is then heated to at least 60°C for between 1 second and 120 minutes, preferably 10 seconds and 30 minutes, most preferably 20 seconds and 15 minutes to form a smooth emulsified gel (coagulated cheese mass). More preferably, the mixture is heated to between 70°C and 90°C, most preferably, heated to between 75°C and 85°C. Optionally the pH of the mixture is then adjusted with a food approved acid or alkali and mixing and heating continued for between 20 seconds and 120 minutes to attain a smooth emulsified gel. Preferably, the ingredients are heated and mixed for between 2 and 10 minutes. Any food approved acid or alkali may be used. The final pH of the coagulated cheese mass may be between 4.5 and 6.5, preferably between 5.0 and 6.0.

The mixture is then cooled to below 50°C and more preferably below 40°C. This may be conducted in the mixer-cooker or may be conducted in a dedicated cooling device to produce a precursor cheese.

At this stage the precursor cheese may be packed. Any convenient product forming, portioning and packing process may be used. The forming, portioning and packing processes used typically for processed cheese are contemplated, as are known devices to produce blocks, tubs, sausages, loafs and pottles. The packed cheese is preferably placed in chilled storage, and more preferably placed in frozen storage. Alternatively, the packed cheese may be used directly or stablised by other means known in the art.

Optionally, when the precursor cheese is cooled, frozen or thawed, it may be shredded or particulated. After shredding the cheese is packed. Bags are a preferred package.

Alternatively once cooled and formed, a concentrate of viable mould organisms is added to the precursor cheese. These organisms may be applied to the surface of the precursor cheese. The viable mould organisms may contain selected species of mould or bacteria cultures or combinations of both. Preferred organisms are those disclosed in the preparation of the flavour concentrate. A preferred means of applying the organisms is to disperse them in sterile water and spray the surface of the precursor cheese. The precursor cheese may be divided into portions before or after the application of the viable organisms.

The organisms are then allowed to ripen the precursor cheese thus producing the cheese product. The treated precursor cheese is preferably placed on a surface in a temperature and humidity controlled space for a period to allow ripening. Preferably ripening is conducted at temperatures between 5°C and 35°C, more preferably between 10°C and 20°C and a relative humidity greater than 80%, preferably greater than 90%. The ripening period may between 1 day and 30 days, and preferably between 5 days and 20 days.

Optionally the ripening of the precursor cheese mass may be facilitated by puncturing the cheese mass with needles or rods to allow the ingress of air. Such a technique is known in the art.

Preferably once the cheese has ripened it is packaged and stored. Freezing is an optional storage technique.

In an alternative embodiment, flavour concentrate containing viable organisms as prepared above may be added and mixed into the precursor cheese. The precursor cheese comprises 0.1% to 20%, preferably 0.5% to 10%, most preferably 2% to 5% of the flavour concentrate. Optionally once formed, the precursor cheese may be sprayed as described above. The treated precursor cheese is then ripened as a above with the preference that the mass is punctured as previously described.

The coagulated cheese mass or the precursor cheese may be formed by passing through an orifice, aperture, nozzle or die, or alternatively poured onto a surface (or surfaces) thus forming a ribbon, slab, sheet or film of a suitable thickness. Optionally, the ribbon, slab, sheet or film may be cooled further to firm or harden it, by contact with cooled air, fluid or a chilled surface or combinations thereof. Preferably the ribbon, slab, sheet or film is portioned.

This ribbon, slab, sheet or film of cheese may be coated with viable organisms and then treated according to the processes described above for ripening.

Optionally, two or more layers of cheese may be laminated together. Each layer may be treated with different viable organisms.

All ranges mentioned in this patent specification are intended to inherently include all of the possible values within the stated range.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any of all combinations of any two or more said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

BRIEF DESCRIPTION OF THE DRAWING

Figure 1 shows a schematic drawing of the process of a preferred embodiment of the invention.

EXAMPLES

The following Examples further illustrate practice of the invention.

General Example: Preparation of Protein Concentrate

Pasteurised skim milk (72°C/15 sec.) was cooled to 10°C and placed in a holding vessel. Rennet was mixed thoroughly into the skim milk at the concentration of 1 part rennet to 18,000 parts skim milk and left to react for several hours.

The renneted milk was then dosed with dilute sulphuric acid (5% w/w) to give a pH of 3.5. The acidified mixture was heated to approximately 44°C by direct steam injection to form a coagulum and held at that temperature for about 60 seconds to cook the coagulum. The serum (whey) was

removed from the coagulum using a solid-bowl decanter. The recovered protein concentrate was washed at about 38°C in water acidified with sulphuric acid to pH 2.5 using a ratio of water to skim milk (equivalent) of 0.5:1. The protein concentrate was allowed 10 minutes in the wash water before being separated using a solid-bowl decanter to give a final protein concentrate. The protein concentrate was salted using 1.5% salt, formed into a cohesive mass and stored chilled at about 5°C until required for use.

Composition of the above protein concentrate is given in the Table below.

Component	Composition (%)
Moisture	51.5
Fat	0.33
Protein	43.4
Salt	1.65
Calcium	178.5 mM/kg
pH	5.61 pH units

Example 1: Preparation of Flavour Concentrate: Blue Cheese

A mixture comprising the following was prepared in a flask

Ingredient	Quantity (g)
Sodium caseinate	50
Sodium chloride	30
Cream (40% fat)	100
Lipase (Enzidase)	0.5
P. Roqueforti spores (Visbyvac DIP DOSIS, Visby, USA)	0.040
Water	1000

The mixture, without the spores was sterilised by heat at about 110°C for 10 minutes. After cooling to room temperature, the spores were added to the flask. The mixture had an initial pH of 6.3. The mixture was sprayed onto the surface of a thin layer of protein concentrate about 5-7 mm thick (as prepared in the General Example above) on a tray. The material was allowed to grow for two days in a humid room at 22-25°C and about 90% RH. The layer of substrate was turned over using a sterile spatula and the freshly exposed surface sprayed as per the first side. This was allowed to ripen for two days as above. The process was repeated so that after eight days the material had been treated and ripened four times.

This concentrate blue cheese potion was used as a flavour ingredient at the rate of 2-5% of the final cheese mass in the blender/cooker (cheese kettle).

Example 2: Preparation of Flavour Concentrate: Mushroom – Camembert

A mixture comprising the following was prepared in a flask:

Ingredient	Quantity (g)
Sodium caseinate	50
Sodium chloride	30
Cream (40% fat)	100
Lipase (Enzidase)	0.5
P. candidium spores (Texel VB 10D, Rhodia Foods)	0.040
Water	1000

The mixture, without the spores, was sterilised at about 100°C for 10 minutes. After cooling to room temperature, the spores were added to the flask. The spore culture was applied to a layer of protein concentrate and grown as for the blue cheese concentrate described in Example 1.

This concentrated Mushroom – Camembert cheese potion was used as a flavour ingredient at the rate of 2-3% of the final cheese mass in the cooker-mixer (cheese kettle).

Example 3: Preparation of Cheese Samples

The following ingredients were placed in a twin-screw blender/cooker (Blentech Kettle model CI0045, Rohnert Park, California, USA):

Ingredient	Quantity (kg)
Protein concentrate (from General Example above)	4.0
High fat cream (80% fat)	2.05
Blue cheese flavour concentrate (from Example 1 above) at 5%	0.26
Water	0.75
Salt	0.015
Tri-sodium citrate	0.12
Di-sodium phosphate	0.06
Citric acid	0.04
Condensate (estimated)	0.9

The blocks of protein concentrate were shredded using an Urschel food grinder and placed with the other ingredients (including the flavour concentrate) in the Blentech Kettle. With the augers set to 140 rpm., the mixture was heated to 83°C with direct steam injection over a period of 4 minutes.

The resulting homogenous mass was poured onto trays (as slabs approximately 25-30 mm thick), which were then allowed to cool to about 10°C. The surface was coated with *P. candidium* spore mixture (0.2 g of the freeze-dried Texel VB 10D culture dispersed in 1 L of sterile water) using a hand sprayer, to give a uniform thin film. The sample was placed in a curing room at about 11°C for 5 days at high humidity. The cheese was peeled from the tray, inverted, and the fresh surface was sprayed as above and returned to the curing room for another 5 days. The cheese was then cut into segments and packed in vacuum sealed bags.

The flavour, aroma and texture was surprisingly similar to a mature Blue cheese made using conventional renneted milk setting, curd cutting and whey draining methods. The surface of the cheese was covered in a whitish layer of mould similar to Camembert or Brie.

Example 4: Preparation of Cheese Samples

The following ingredients were placed in a twin-screw blender/cooker (Blentech Kettle model CI0045, Rohnert Park, California, USA):

Ingredient	**Quantity (kg)**
Protein concentrate (from General Example above)	4.0
High fat cream (80% fat)	2.05
Blue cheese flavour concentrate (from Example 1 above) at 3%	0.156
Water	0.75
Salt	0.015
Tri-sodium citrate	0.12
Di-sodium phosphate	0.06
Citric acid	0.04
Condensate (estimated)	0.9

Previously frozen blocks of the protein concentrate were shredded using an Urschel food grinder and placed with the other ingredients (including the flavour concentrate) in the Blentech cooker. With the augers set to 140 rpm., the mixture was heated to 83°C with direct steam injection over a period of 4 minutes.

The resulting homogenous mass was poured onto trays (as slabs approximately 25-30 mm thick), which were then placed in a cool room overnight at about 5°C (without being coated with spores). The samples were then cut into segments, sealed in vacuum bags and frozen at -18°C.

Upon thawing, the flavour, aroma, and texture was surprisingly similar to a moderately ripened Blue cheese.

Example 5: Preparation of Cheese Samples

The following ingredients were placed in a twin-screw blender/cooker (Blentech Kettle model CI0045, Rohnert Park, California, USA):

Ingredient	Quantity (kg)
Protein concentrate (from General Example above)	4.0
High fat cream (80% fat)	2.05
Mushroom/Camembert cheese concentrate (from Example 2 above) at 3%	0.156
Blue cheese flavour concentrate (from Example 1 above) at 2%	0.104
Water	0.75
Salt	0.015
Tri-sodium citrate	0.12
Di-sodium phosphate	0.06
Citric acid	0.04
Condensate (estimated)	0.9

The cheese was prepared according to the method in Example 3.

When the cheese had cooled to about 10°C, the surface was coated with the *P. candidium* mixture and allowed to ripen as in Example 3.

The ripened cheese had a taste and appearance similar to the cheese of Example 3, but a milder blue/mushroom flavour and a whitish coating of mould.

Example 6: Preparation of Cheese Samples

The following ingredients were placed in a twin-screw blender/cooker (Blentech Kettle model CI0045, Rohnert Park, California, USA):

Ingredient	Quantity (kg)
Protein concentrate (from General Example above)	4.0

High fat cream (80% fat)	2.05
Mushroom/Camembert cheese concentrate (from Example 2 above) at 2%	0.104
Blue cheese flavour concentrate (from Example 1 above) at 3%	0.156
Water	0.75
Salt	0.015
Tri-sodium citrate	0.12
Di-sodium phosphate	0.06
Citric acid	0.04
Condensate (estimated)	0.9

The cheese was prepared according to the method in Example 4, i.e. the surface of the cheese was not coated with spores.

The flavour, aroma, and texture was surprisingly similar to a mild blue cheese.

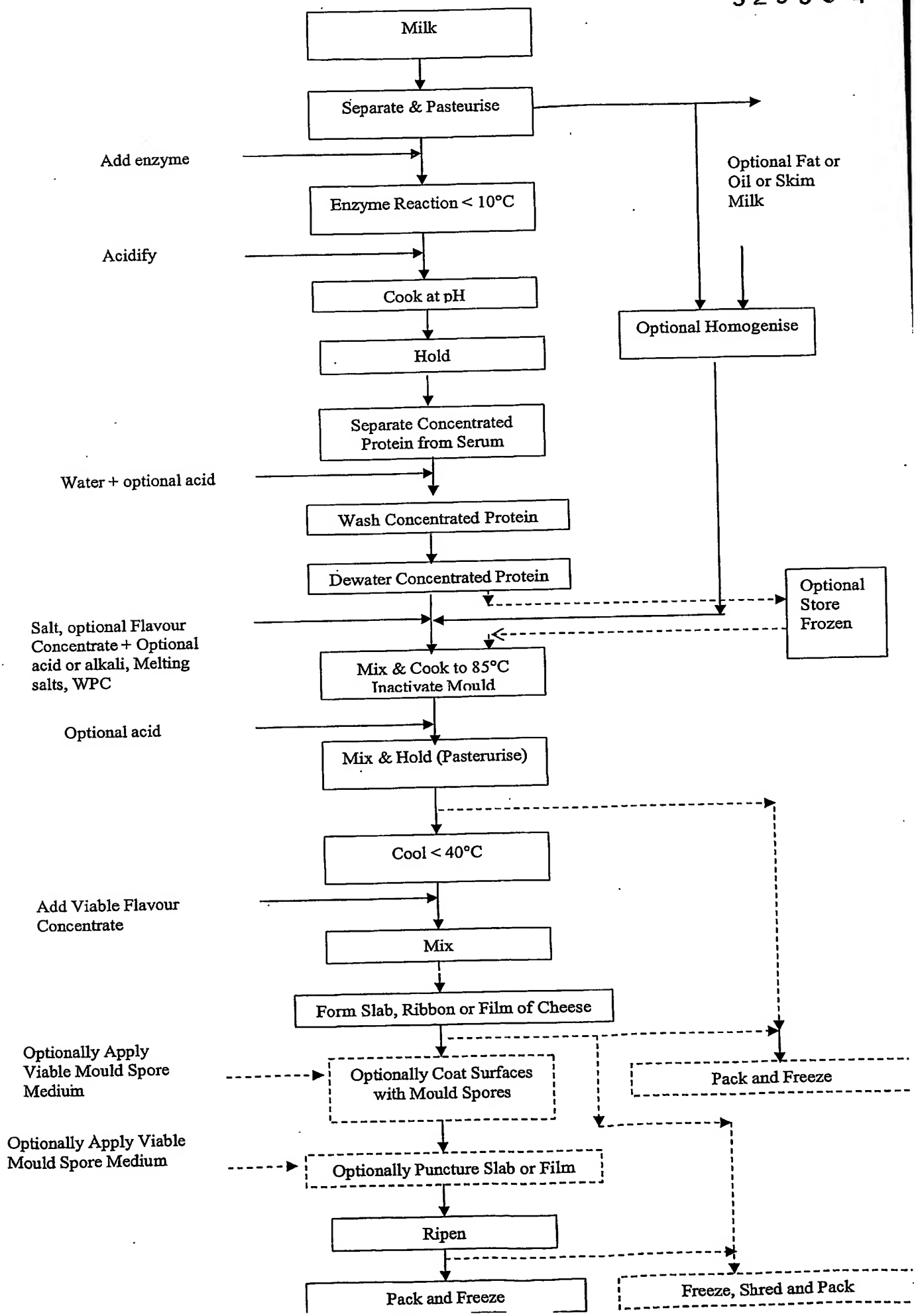
The cheese samples produced in Examples 2-6 had compositions in the following range:

Moisture	49-55%
Fat	19-22%
Protein	20-22%
Salt	0.95-1.1%
pH	5.59-5.68

The above examples are illustrations of the practice of the invention. It will be appreciated by those skilled in the art that the invention can be carried out with numerous modifications and variations. For example, the pH, temperature, times and types of ripening organisms used can all be varied. Likewise the constituents of the cheeses can be varied as well as their proportions.

By the authorised agents
A J PARK

Per


Milk
Separate & Pasteurise
Add enzyme
Optional Fat or Oil or Skim Milk
Enzyme Reaction < 10°C
Acidify
Cook at pH
Optional Homogenise
Hold
Separate Concentrated Protein from Serum
Water + optional acid
Wash Concentrated Protein
Dewater Concentrated Protein
Optional Store Frozen
Salt, optional Flavour Concentrate + Optional acid or alkali, Melting salts, WPC
Mix & Cook to 85°C Inactivate Mould
Optional acid
Mix & Hold (Pasterurise)
Cool < 40°C
Add Viable Flavour Concentrate
Mix
Form Slab, Ribbon or Film of Cheese
Optionally Apply Viable Mould Spore Medium
Optionally Coat Surfaces with Mould Spores
Pack and Freeze
Optionally Apply Viable Mould Spore Medium
Optionally Puncture Slab or Film
Ripen
Pack and Freeze
Freeze, Shred and Pack